

Therefore, the following is claimed:

1. A method of printing an image onto a substrate comprising:  
depositing onto a substrate a substance that is stable until contacted with a curing medium, the  
substance having a dye contained therein;  
5           at least partially curing the substance on the substrate by applying the curing medium thereto; and  
            forming the image on the substrate by dyeing the substrate with the dye from the deposited substance.
2. The method of printing of claim 1 wherein:  
the substrate is a textile;  
the substance includes UV curable monomers that polymerize when contacted by UV radiation;  
10           the depositing includes jetting the substance containing the dye onto the textile;  
            the curing includes contacting the monomers deposited on the substrate with UV radiation to form a  
polymer on the surface of the textile; and  
            the forming of the image occurs as dye from the surface of the substrate moves into bonding contact  
with fibers of the textile.
- 15           3. The method of claim 1 or claim 2 wherein:  
the depositing includes jetting an ink composition containing a UV curable component and a dye  
component; and  
the curing includes substantially curing at least the jetted UV curable component on the substrate by  
exposing the UV curable component to UV light, the curing resulting in a substantially cured UV component  
20           on the substrate containing the dye component.
4. The method of claim 3 wherein:  
the forming of the image includes heating the substrate having the substantially cured UV cured  
component thereon and thereby effecting the dyeing of the fabric with the dye component.
5. The method of claim 4 wherein:  
25           the curing results in the substantially cured UV component containing uncured monomers of the UV  
curable component; and  
the heating includes reducing the level of the uncured monomers of the UV curable component on the  
fabric.
6. The method of claim 1 or claim 2 wherein:  
30           the substance has a pigment included therein; and  
the curing includes fixing the pigment in the cured substance on the surface of the substrate.

7. The method of claim 1 or claim 2 wherein:  
the depositing includes jetting onto the substrate a substance containing a UV curable component and  
a dye component; and  
the curing includes substantially curing at least the UV curable jetted component on the substrate by  
5 exposing the UV curable component on the substrate to UV radiation.
8. The method of claim 7 wherein:  
the forming of the image includes heating the substance containing the substantially cured exposed UV  
component and the dye component on the substrate.
9. The method of claim 8 wherein:  
10 the substantially cured UV curable component includes at least some uncured monomers and the  
heating of the substance includes reducing the amount of uncured monomers on the substrate.
10. The method of claim 7 further comprising:  
heating the substance containing the substantially cured exposed UV component and the dye  
component on the substrate;  
15 the heating includes contacting the substrate with a heated plate.
11. The method of claim 1 or claim 2 wherein:  
the depositing includes printing the substance onto a large area substrate.
12. The method of claim 1 or claim 2 wherein:  
the at least partial curing of the substance on the substrate includes freezing the substance on the  
20 substrate by applying the curing medium to the substance immediately upon the printing thereof to reduce the  
spread of the substance on the substrate.
13. The method of claim 1 or claim 2 wherein:  
the at least partial curing of the substance on the substrate includes freezing the substance on the  
substrate by exposing the substance to UV light immediately upon the printing thereof onto the substrate to  
25 reduce the spread of the substance on the substrate.
14. The method of claim 1 wherein:  
the forming of the image includes contacting the substrate having the at least partially cured substance  
thereon with a heated plate.
15. The method of claim 1 wherein:  
30 the substance is a polymerizable substance containing the dye;  
the curing includes polymerizing the substance by initiating a polymerizing reaction in the substance  
and maintaining the reaction until the substance is substantially polymerized.

16. The method of claim 15 wherein:  
the forming of the image includes heating the substantially polymerized substance and the dye contained therein while on the substrate to effect the dyeing of the substrate.
- 5 17. The method of claim 1 or claim 14 or claim 15 or claim 16 wherein:  
the depositing includes the jetting of the substance onto the substrate.
18. The method of claim 16 wherein:  
the at least partially cured substance includes at least some unpolymerized monomers and the heating includes reducing the amount of unpolymerized monomers on the substrate.
- 10 19. The method of claim 1 or claim 2 wherein:  
the substance is a curable liquid having the dye component contained therein;  
the curing includes at least partially solidifying the liquid on the surface of the substrate.
20. The method of claim 19 wherein:  
the forming of the image includes heating the at least partially solidified liquid on the surface of the substrate so as to effect the dyeing of the substrate.
- 15 21. The method of claim 1 wherein:  
the depositing includes jetting onto the substrate a curable liquid polymer having the dye suspended therein;  
the curing includes substantially curing the liquid polymer on the substrate to fix the position of the suspended dye on the substrate.
- 20 22. The method of claim 21 further comprising:  
heating the substantially cured liquid polymer on the substrate to activate the dye and thereby effect the dyeing of the substrate.
23. The method of claim 22 wherein:  
the dye is a sublimation dye;  
25 the heating includes heating the dye to sublime the dye to dye the substrate.
24. The method of claim 22 wherein:  
the curable liquid polymer is a UV curable substance;  
the dye is a sublimation dye;  
the curing includes exposing the substance to UV light for a sufficiently short time after jetting the  
30 substance onto the substrate to at least partially prevent a spreading of the polymer on the substrate; and  
the heating includes heating the dye to sublime the dye.

25. A digital printing method comprising:  
driving a printhead across a substrate with a linear servo motor; and  
digitally printing an image on the substrate therewith.
- 5 26. The method of claim 25 wherein:  
the printing includes jetting ink from the print head onto the substrate.
27. The method of claim 26 further comprising:  
controlling the jetting of the ink by advancing the timing thereof in relation to the speed of the print  
head across the substrate.
- 10 28. The method of claim 26 further comprising:  
controlling the jetting of the ink by advancing the timing thereof in relation to the speed of the print  
head across the substrate to compensate for transverse displacement of the ink due to the velocity of the print  
heads parallel to the substrate.
- 15 29. The method of claim 25 wherein:  
the driving of the print head includes accelerating and decelerating the print head while driving it  
across a substrate with the linear servo motor; and  
the printing includes printing on the substrate while the head is accelerating or decelerating.
- 20 30. The method of claim 29 wherein:  
the printing includes jetting ink from the print head onto the substrate while the head is accelerating  
or decelerating.
31. The method of claim 30 further comprising:  
controlling the jetting of the ink by advancing the timing thereof in relation to the speed of the print  
head across the substrate.
- 25 32. The method of claim 26 further comprising:  
controlling the jetting of the ink by advancing the timing thereof in relation to the speed of the print  
head across the substrate to compensate for transverse displacement of jetting ink due to the velocity of the print  
heads parallel to the substrate.
33. The method of claim 25 wherein:  
the substrate is a textile; and  
the printing includes jetting ink from the print head onto the surface of the textile.

34. A method of printing onto textiles comprising:  
removing fibers from the surface of the substrate; then  
ink jet printing onto the substrate.
- 5 35. The method of claim 34 wherein:  
the removing of the fibers includes shaving the surface of the substrate.
36. The method of claim 34 wherein:  
the removing of the fibers includes singeing the surface of the substrate.
37. The method of claim 34 wherein:  
the removing of the fibers is performed on the substrate when supported on the frame of a printing  
10 machine; and  
the printing is carried out while the substrate is still supported on the frame of the printing machine.
38. An ink jet printing apparatus comprising:  
means for jetting onto a substrate a substance containing a curable component and a dye component;  
means for substantially curing at least the curable jetted component on the substrate by exposing the  
15 curable component on the substrate to a curing medium.
39. The apparatus of claim 38 further comprising:  
means for heating the substrate having the cured component and dye component thereon.
40. The apparatus of claim 38 further comprising:  
a heated plate configured to thermally contact the substrate having the cured component and dye  
20 component thereon.
41. The apparatus of claim 38 further comprising:  
a bridge extending parallel to the substrate;  
an ink jet printhead carriage moveable on the bridge;  
a linear servo connected to the bridge and the printhead carriage so as to drive the carriage across the  
25 bridge; and  
a programmed controller connected to the servo to control the motion of the carriage on the bridge.
42. A digital printing apparatus comprising:  
a substrate support;  
a linear servo motor extending parallel to the support;  
30 a digital printhead moveable on the linear servo motor parallel to the support and directed toward the  
support;

a controller operable to drive the linear servo motor parallel to the support and to operate the print head in synchronism with the movement of the servo motor so print an image on a substrate on the support in accordance with data from an electronic source file.

5           43. The apparatus of claim 42 wherein:  
            the printhead is an ink jet printhead.

            44. The apparatus of claim 43 wherein:  
            the controller is operable to time the jetting of the ink from the printhead in relation to the speed of the linear servo motor.

10           45. The apparatus of claim 43 wherein:  
            the controller is operable to time the jetting of the ink from the printhead in relation to the speed of the linear servo motor by advancing or retarding the timing of the jetting of the ink from the printhead in relation to the speed of the print head across the substrate to compensate for transverse displacement of the ink due to the velocity of the printhead parallel to a substrate on the support.

15           46. The apparatus of claim 42 wherein:  
            the controller is operable to control the printing of the printhead so as to accurately produce an image from the electronic source file when the servo motor is accelerating or decelerating.

            47. A textile printing apparatus comprising:  
            a substrate support;  
            a bridge extending across the support;  
20           an ink jet print head moveable across the bridge and positioned to deposit a dot pattern of ink onto a substrate on the support;  
            a computer controlled linear servo motor positioned to move the printhead across the bridge.

            48. A method of printing onto textiles comprising:  
            providing a substrate support with a layer of non-stick protective material;  
25           supporting a textile having pores therein above the substrate support with the layer of non-stick protective sheet material between the substrate support and the substrate;  
            jetting UV curable ink onto the substrate with some of the ink passing through the pores of the substrate onto the layer of material;  
            exposing the jetted UV curable ink to UV light;  
30           removing the substrate from above the support;  
            wiping exposed UV curable ink from the layer of protective sheet material.

49. The method of claim 48 wherein:

the non-stick protective material is a coating of material on the support to which UV ink, jetted thereon and at least partially cured, has an adhesive force sufficiently high to prevent such ink from being wiped from the coating by the friction of the substrate sliding over the support, but has an adhesive force that is, or can be made, sufficiently low to allow such ink to be cleaned from the support; and

the textile is supported on the substrate support in contact with the layer of non-stick protective sheet material.

50. The method of claim 48 wherein:

the supporting of the textile above the substrate support includes extending the substrate in tension, spaced from the substrate support adjacent the layer of non-stick protective sheet material at least in a region between the printhead and the substrate support.

51. An ink jetting printing apparatus comprising:

a substrate table;

a layer of non-stick protective material overlying the table so as to collect, and protect the substrate support from, ink jetted toward a porous substrate over the table and passing through the porous substrate;

an ink jet printhead directed toward the table;

a curable head positioned adjacent the table to facilitate the curing of ink jetted from the printhead toward a substrate over the table.

52. The apparatus of claim 51 wherein the non-stick protective material is TEFLON.

53. The apparatus of claim 51 wherein the curing head includes a primary UV light curing source positioned to expose ink that has been jetted onto a substrate over the table.

54. The apparatus of claim 53 wherein the curing source is mounted on or near a carriage on which the printhead is mounted so as to cure ink immediately after it reaches the substrate so that the dots of ink are frozen before they have a chance to flow into the substrate or spread.

55. The apparatus of claim 53 wherein the UV source has a focal length sufficiently long so that the light penetrates holes in the substrate and cures ink on the underlying layer.

56. The apparatus of claim 51 wherein the non-stick protective material is a coating of material on the table to which UV ink, jetted thereon and at least partially cured, has an adhesive force sufficiently high to prevent such ink from being wiped from the coating by the friction of the substrate sliding over the table, but has an adhesive force that is, or can be made, sufficiently low to allow such ink to be cleaned from the table.

57. The apparatus of claim 51 further comprising:  
guide structure configured and positioned to support the substrate proximate to but out of contact with the non-stick protective material at least in a region between the printhead and the substrate table.

58. The apparatus of claim 57 wherein:  
5 the guide structure includes transversely extending sets of pinch elements, one set located upstream of the printhead and one set located downstream of the printhead, to hold the substrate in tension proximate but out of contact with the table.

59. The apparatus of claim 57 wherein:  
10 the guide structure includes transversely extending pairs of rollers, one pair located upstream of the printhead and one pair located downstream of the printhead, to hold the substrate proximate but out of contact with the table.

60. An ink jetting printing apparatus comprising:  
a substrate support;  
a layer of non-stick protective material overlying the support so as to collect, and protect the substrate  
15 support from, ink jetted toward a porous substrate on the support and passing through the porous substrate;  
an ink jet printhead directed toward the support;  
a curable head positioned adjacent the support to facilitate the curing of ink jetted from the printhead toward a substrate on the support.

61. An ink jet printing apparatus comprising:  
20 an ink jet printhead configured to jet UV curable ink onto a substrate;  
a UV curing head configured to at least partially cure UV curable ink jetted onto the substrate; and  
a heated plate configured to thermally contact the substrate having the at least partially cured UV curable ink thereon.

62. The apparatus of any of claims 38 through 61 further comprising:  
25 means for cleaning an ink jet printhead.

63. An ink jet printing apparatus comprising:  
a frame having a substrate support area thereon;  
an ink jet printhead configured to jet onto a substrate on the substrate support area a UV curable ink;  
a UV source configured to substantially cure the UV curable ink on the substrate; and  
30 a head cleaning station beside the substrate support area having located thereat means for purging the printhead and wiping the printhead.